

IN THE CLAIMS

1. (currently amended) A transmitting apparatus, comprising:

a training signal generating unit operable to generate a training signal;

a transmission data generating unit operable to generate data desired to be transmitted;

a quadrature modulation unit operable to subject a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form a quadrature modulated signal;

a first transmitting unit operable to transmit a first signal component of [[a]] the quadrature modulated signal as a signal in which data desired to be transmitted is modulated; and

a second transmitting unit operable to transmit a second signal component of the quadrature modulated signal as [[a]] the training signal, the second signal component being orthogonal to the first signal component, the first signal component being an in-phase signal component, and the second signal component being a quadrature signal component.

2. (canceled)

3. (currently amended) A transmitting apparatus, comprising:

a training signal generating unit operable to generate a training signal;

a transmission data generating unit operable to generate data desired to be transmitted;

a quadrature modulation unit operable to subject a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form a quadrature

modulated signal;

a first transmitting unit operable to transmit a first signal component of [[a]] the quadrature modulated signal as a signal in which data desired to be transmitted is modulated; and

a second transmitting unit operable to transmit a second signal component of the quadrature modulated signal as [[a]] the training signal, the second signal component being orthogonal to the first signal component, the first signal component being a quadrature signal component, and the second signal component being an in-phase signal component.

4. (previously presented) A transmitting apparatus as claimed in claim 1, wherein the training signal is formed by a known data sequence generated on the basis of a predetermined clock.

5. (canceled)

6. (currently amended) A signal transmitting method, comprising the steps of:

generating a training signal;

generating data desired to be transmitted;

subjecting a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form a quadrature modulated signal;

transmitting a first signal component of [[a]] the quadrature modulated signal as a signal in which data desired to be transmitted is modulated; and

transmitting a second signal component of the quadrature modulated signal orthogonal to the first signal component as [[a]] the training signal, the first signal component being an in-phase signal component, and the second signal component being a quadrature signal component.

7. (currently amended) A receiving apparatus, comprising:

a receiving unit operable to receive a signal including first and second signal components of a quadrature modulated signal, the first signal component including a signal in which data desired to be transmitted is modulated, and the second signal component being orthogonal to the first signal component and being transmitted as a training signal, the first signal component being an in-phase signal component, and the second signal component being a quadrature signal component;~~and~~

a generating unit to generate the training signal at the receiving unit;

a processing unit to process the receiver-generated training signal, thereby generating a processed signal;

a first correlation circuit to correlate the first component of the received signal with a component of the processed signal;

a second correlation circuit to correlate the second component of the received signal with the component of the processed signal; and

an equalizer operative to adaptively equalize the first signal component according to the output of the first and second correlation circuits using the training signal.

8. (canceled)

9. (currently amended) A receiving apparatus, comprising:

a receiving unit operable to receive a signal including first and second signal components of a quadrature modulated signal, the first signal component including a signal in which data desired to be transmitted is modulated, and the

second signal component being orthogonal to the first signal component and being transmitted as a training signal, the first signal component being a quadrature signal component, and the second signal component being an in-phase signal component;~~and~~

a generating unit to generate the training signal at the receiving unit;

a processing unit to process the receiver-generated training signal, thereby generating a processed signal;

a first correlation circuit to correlate the first component of the received signal with a component of the processed signal;

a second correlation circuit to correlate the second component of the received signal with the component of the processed signal; and

an equalizer operative to adaptively equalize the first signal component using the output of the first and second correlation circuits ~~the training signal.~~

10. (previously presented) A receiving apparatus as claimed in claim 7, wherein the training signal is formed by a known data sequence.

11. (previously presented) A receiving apparatus, comprising:

a receiving unit operable to receive a transmission signal including first and second signal components of a quadrature modulated signal, the first signal component including a signal in which data desired to be transmitted is modulated, and the second signal component being orthogonal to the first signal component and being transmitted as a training signal;

a signal separator operable to separate the transmission signal into a third signal component corresponding

to the first signal component and a fourth signal component orthogonal to the third signal component and corresponding to the second signal component;

an equalizer operable to equalize the third signal component;

a signal generator operable to generate a known signal identical to the training signal; and

a correlation unit operable to use the third signal component, the fourth signal component and the known signal to obtain a ratio between a level of the second signal component included in the third signal component and a level of the second signal component formed by a direct wave included in the fourth signal component, a ratio between a level of the second signal component formed by an indirect wave included in the fourth signal component and the level of the second signal component formed by the direct wave included in the fourth signal component, a time difference between the second signal component included in the third signal component and the known signal, and a time difference between the second signal component formed by said direct wave included in the fourth signal component and the second signal component formed by the indirect wave included in the fourth signal component;

whereby equalizing characteristics of the equalizer are adjusted on the basis of results obtained by the correlation unit.

12. (currently amended) A signal receiving method, comprising the steps of:

receiving a signal including first and second signal components of a quadrature modulated signal, the first signal component including a signal in which data desired to be transmitted is modulated, and the second signal component being orthogonal to the first signal component and being transmitted

as a training signal, the first signal component being an in-phase signal component, and the second signal component being a quadrature signal component;~~and~~

generating the training signal at a receiving unit;

processing the receiver-generated training signal to generate a processed signal;

correlating the first component of the received signal with a component of the processed signal;

correlating the second component of the received signal with the component of the processed signal; and

adaptively equalizing the first signal component using the results of said correlating steps ~~training signal~~.

13. (currently amended) A transmitting and receiving apparatus for transmitting and receiving a signal modulated by quadrature modulation, the transmitting and receiving apparatus comprising:

a training signal generating unit operable to generate a training signal;

a transmission data generating unit operable to generate data desired to be transmitted;

a quadrature modulation unit operable to subject a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form a quadrature modulated signal;

a transmitting unit operable to transmit a transmission signal including a first signal component of [[a]] the quadrature modulated signal as a signal in which data desired to be transmitted is modulated, and a second signal component of said the quadrature modulated signal as [[a]] the training signal, the second signal component being orthogonal to the first signal component, the first signal component being an in-phase signal component, and the second signal component being

a quadrature signal component; and

a receiving unit operable to receive the transmission signal and to adaptively equalize the first signal component using the training signal.

14. (canceled)

15. (currently amended) A transmitting and receiving apparatus for transmitting and receiving a signal modulated by quadrature modulation, the transmitting and receiving apparatus comprising:

a training signal generating unit operable to generate a training signal;

a transmission data generating unit operable to generate data desired to be transmitted;

a quadrature modulation unit operable to subject a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form a quadrature modulated signal;

a transmitting unit operable to transmit a transmission signal including a first signal component of [[a]] the quadrature modulated signal as a signal in which data desired to be transmitted is modulated, and a second signal component of the quadrature modulated signal as [[a]] the training signal, the second signal component being orthogonal to the first signal component, the first signal component being a quadrature signal component, and the second signal component being an in-phase signal component; and

a receiving unit operable to receive the transmission signal and to adaptively equalize the first signal component using the training signal.

16. (previously presented)

A transmitting and

receiving apparatus as claimed in claim 13, wherein the training signal is formed by a known data sequence.

17. (canceled)

18. (previously presented) A transmitting and receiving apparatus for transmitting and receiving a signal modulated by quadrature modulation, the transmitting and receiving apparatus comprising:

a transmitting unit operable to transmit a transmission signal including a first signal component of a quadrature modulated signal as a signal in which data desired to be transmitted is modulated, and a second signal component of the quadrature modulated signal as a training signal, the second signal component being orthogonal to the first signal component; and

a receiving unit operable to receive the transmission signal and to adaptively equalize the first signal component using the training signal, wherein

the transmitting unit includes:

a training signal generating unit operable to generate the training signal;

a transmission data generating unit operable to generate the data desired to be transmitted;

a quadrature modulation unit operable to subject a data signal based on the data desired to be transmitted and the training signal to quadrature modulation to form the quadrature modulated signal; and

a transmitter operable to transmit the quadrature modulated signal,

the receiving unit includes:

a signal separator operable to separate the transmission signal into a third signal component corresponding



to the first signal component and a fourth signal component orthogonal to the third signal component and corresponding to the second signal component;

an equalizer operable to equalize the third signal component;

a signal generator operable to generate a known signal identical to the training signal; and

a correlation unit operable to use the third signal component, the fourth signal component and the known signal to obtain a ratio between a level of the second signal component included in the third signal component and a level of the second signal component formed by a direct wave included in the fourth signal component, a ratio between a level of the second signal component formed by an indirect wave included in the fourth signal component and the level of the second signal component formed by the direct wave included in the fourth signal component, a time difference between the second signal component included in the third signal component and the known signal, and a time difference between the second signal component formed by the direct wave included in the fourth signal component and the second signal component formed by the indirect wave included in the fourth signal component;

whereby equalizing characteristics of the equalizer are adjusted on the basis of results obtained by the correlation unit.

19. (currently amended) A method for transmitting and receiving a signal modulated by quadrature modulation, the method comprising the steps of:

generating a training signal;

generating data desired to be transmitted;

subjecting a data signal based on the data desired to be transmitted and the training signal to quadrature modulation

to form a quadrature modulated signal;

transmitting a transmission signal including a first signal component of ~~[[a]]~~ the quadrature modulated signal as a signal in which data desired to be transmitted is modulated and a second signal component of the quadrature modulated signal orthogonal to the first signal component as ~~[[a]]~~ the training signal, the first signal component being an in-phase signal component, and the second signal component being a quadrature signal component; and

receiving the transmission signal and adaptively equalizing the first signal component using the training signal.